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Operation

DOMINIC II

SHOT SMALL BOY

PROJECT OFFICERS REPORT—PROJECT 7.14

BOMB ALARM DETECTOR TEST (U)

Cecil C. Harvell, Project Officer

and the staff of
Western Union Telegraph Company
New York, New York

Directorate of Telecommunications,
AFOAC
Washington 25, D.C.

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ABSTRACT

The bomb alarm system was designed and installed by Western Union Telegraph Company. The various components of the system, including the sensors, have been tested under laboratory conditions. The primary purpose of the test was to prove unequivocally that the sensors would recognize a nuclear event and transmit a message to be displayed at some distant location indicating such an occurrence. The secondary purpose of the test was to ascertain the electromagnetic (EM) effect of a nuclear reaction on communications facilities utilized to connect the various elements of the alarm.

To achieve these results, several sensors were installed and connected to the nationwide system and to instrumentation. These configurations were to determine that the system was responsive, or, if not, to indicate where the system failed, in order that proper design changes can be incorporated into the system to achieve the desired operational intent.

The sensors, connected to the nationwide system, were installed in a configuration environmental to the other sensors of the nationwide system. Since this is an unattended system, these sensors detected, transmitted, and displayed the event upon occurrence.

The instrumented sensors checked the go, no-go of the various actions required of the sensor elements in recognizing a nuclear detonation and transmitting a signal to this effect.

The instrumented open-wire line was to determine the electromagnetic inductive effect on such facilities. This information was to determine whether or not the EM effect would deter the transmission of the signal by the sensor.

Performance of the various sensors and the electromagnetic phenomena of the open-wire lines was recorded on oscilloscope camera film, magnetic and teleprinter tapes. This information confirms theoretical calculations relative to sensitivity and range of the sensors.

CONTENTS

CHAPTER 1

INTRODUCTION

1.1 OBJECTIVES

The primary objective of this test was to insure that the bomb alarm sensors would positively react upon observance of a nuclear event.

The secondary objective of this test was to obtain information with regard to electromagnetic (EM) inductive effect on various types of communications plant facilities.

1.2 BACKGROUND

The bomb alarm system, including the detectors, was designed by Western Union. The detectors utilized have been tested under laboratory conditions, utilizing a nuclear flash simulator as described below.

Briefly, a photoflash lamp and a photospot lamp are energized sequentially, the photoflash lamp being energized with a pulse of current having a first predetermined wave shape, and the photospot lamp being energized with a pulse of current having a second pre-determined wave shape. The combination simulates the thermal energy generated by the occurrence of a nuclear explosion.

1.3 THEORY

1.3.1 System Operation. Briefly, the operation of Bomb Alarm Display System 210-A is as follows: The system is under continuous operation and observes selected designated areas considered to be of prime importance in the contiguous states of the United States. Each of these designated areas is observed by three (or a multiple of three) omnidirectional detectors, each of which has associated with it a signal-generating station capable of initiating a message indicating the recognition by the detector of a nuclear event. A number of these signal generating stations are connected by duplex circuits into a master control center that is the control center for these stations. Each master control center has the capability of polling all of its associated signal generating stations. Upon receipt of this polling message, the signal-generating stations have the capability of transmitting a message in reply that normally would indicate that its associated detector was in proper working order and that no nuclear event was being observed (green light - normal condition). At the conclusion of each polling sequence, each master control center transmits the status of each of its signal generating stations over trunk circuits to all display centers. Thus, the status of each area is displayed at all times with respect to

(1) recognition of a nuclear event (red light - alarm condition), (2) readiness to report such an event if it were to occur (green light - normal condition), and (3) equipment or circuit malfunction (yellow light - trouble condition), initiated by the master control center when trouble is indicated during polling.

<u>1.3.2 Detectors.</u> The detectors used in the system are designed to detect the thermal radiation from nuclear blasts and to operate continuously. They have a minimum foggy weather range of more than 19 miles and cover a field extending from 0 degrees to 10 degrees in elevation and from 0 degrees to 360 degrees in azimuth. They are used in groups of three, spaced at approximately 120 degree intervals and 11 miles distant from the center of the area under observation. With this arrangement, the distance between any two detectors is 19 miles. The detectors are installed at the tops of poles or on suitable buildings or similar structures.

A blast at the center would be reported by all of the three detectors, for the 11-mile distance is well within their range, and at this distance there is ample time for the detector to report the event before the arrival of the blast wave. All connecting wires and other system elements are outside the central area. If the blast were close enough to one of

the detectors to destroy it before it could report, the other two detectors in the group would send the alarm.

The detector receives its operating power over a pair of wires from the telegraph signal-generating station at about 30 volts and 0.06 ampere dc. Signals from the detector to the signal-generating station pass over the same wires in the form of audio-frequency tones, a continuous 1100 cps indicating a normal green condition, and a one-second burst of approximately 920 cps followed by a one-second burst of approximately 740 cps indicating a red alarm. The signal generating station may be some considerable distance from the detector, depending on the resistance and permissible line voltage.

The detector is housed in a heavy, airtight, aluminum, cylindrical container, about 9 inches in diameter and 1 foot high, painted white on the outside to reflect solar heat, and is surmounted by a cylindrical fresnel-type marine lens. Within the lens is a cylindrical perforated metal shield that has a light attenuation factor of 100, and, within the shield, photocells of the silicon sun battery type are mounted at the focus of the lens.

The individual photocells are thin plates of 1 by 2 cm and three of them are mounted at the focus in a triangular structure, 2 cm high and 1 cm on a side, with the sensitive

surface on the outer face. They are a photovoltaic type of cell that responds to the wave length range from 0.4 to 1.1 microns and thus are well matched to the black-body type and temperature of the nuclear blast. As used in the detector, they have a logarithmic response, producing 0.2 volt for a minimum event and 0.8 volt for a flash that is a million times brighter. Their response time is only a few microseconds.

The electrical pulse generated in the photocells by a nuclear blast is amplified and put into discriminating circuits. These circuits are designed to respond only to pulses of sufficient magnitude and of the shape that is unique to a nuclear blast and to perform a series of five successive tests to assure that an alarm will be given only in the event of a nuclear flash. First, the thermal energy must lie in the wave length range between 0.4 and 1.1 microns. Second, the rise time of the flash must be very short, of the order of 30 microseconds or less. Third, the intensity or amplitude must be at least comparable to that of the noonday sun i.e., 10,000 ft-candle. Fourth, the initial pulse must rise to a minimum of 10,000 ft-candle and decay to one-half value within 30 msec. Fifth, the second peak must rise to a minimum of 10,000 ft-candles in one second and sustain for at least one additional second.

CHAPTER 2

OPERATIONS

2.1 EQUIPMENT CONFIGURATION

In order to test the detectors in this shot, it was necessary, due to the difference in time amplitude characteristic of the thermal pulse generated by this smaller event, to effect a change in the sampling times of the detectors. These modifications were made by Western Union, prior to shipment of the equipment.

The detector modifications consisted of reducing the first pulse sampling time from thirty to two msec and the second pulse sampling time from one second to sixty msec.

The signal-generating stations were also modified so as to react to the reduced time cycle. The red alarm signal from a standard sensor consists of a shift to 920-cps tone for one second followed by a shift to a 740-cps tone for one additional second. The signal-generating stations were designed to require the presence of these tones for an appreciable portion of a second in order to reduce the hazard of generating false reds from spurious bursts of tones or noise. The modified sensors send the 920-cps tone for only sixty msec followed by red tone for one second. The time constant of the 920-cps tone

detector in these signal-generating stations had to be reduced so that the station would react to a fifty-msec burst of tone.

Because the intensity of the radiation was only 1 per cent of that for which the system was designed, three detectors were mounted at 1/10th of the normal distance from ground zero (at one mile) so as to expose them to normal intensities. These one-mile detectors were connected by cable circuits to signal-generating stations at the instrumentation site located approximately 4 miles from ground zero (0.9 mile east of the intersection of Mercury Highway and the east-west road into Frenchman Flat). From the instrumentation site, three telegraph circuits into Las Vegas connected these generating stations into the 210-A Nationwide Alarm System by way of the master control stations located at Helena, Montana, Salt Lake City, Utah, and Tulsa, Oklahoma.

Additional detectors were installed in a configuration that placed them at distances of approximately 1/2, 1, 2, 4, 7 and 12 miles from ground zero to further check their sensitivity and range (Figure 2.1). The detectors were connected by cable circuits to the instrumentation site.

In addition to the test of the detectors, an open-wire line was constructed from a point 1/2 mile from ground zero to a point approximately 2 1/2 miles from ground zero and extended

from there by means of 1 1/2 miles of twisted pair field wire to the instrumentation site. At the 1/2 mile point the open-wire line was resistively terminated and a spark gap lightning arrestor was placed between each wire and a driven ground rod. (It is quite certain that this was a poor ground due to the dry nature of the soil). At the instrumentation site the other end of this line was connected to oscilloscopes so that the time-amplitude relationship of any EM effects might be measured.

A portable radiation instrument was connected to a channel of a tape recorder at the instrumentation site to provide an indication of the intensity of gamma radiation at this distance.

The instrumentation site consisted of an air-cooled trailer in which were housed all of the sensitive instruments. Adjacent to the trailer were mounted four detectors and such other optical instruments as were necessary to measure the time-amplitude relationship of the thermal emission of the event as well as to generate the precise type of synchronizing pulse necessary to make the measurements (see Figure 2.2).

2.2 INSTRUMENTATION CONFIGURATION

The equipment within the trailer fell into five general

categories (Figure 2.3). The primary group consisted of three generating stations and teletype equipment (mentioned above) which were tied into the Nationwide Alarm circuit. Another group consisted of two oscilloscopes (with recording cameras), two electronic counters, and a magnetic tape recorder to monitor the performance of the detail segments of a sensor mounted adjacent to the trailer. A third group was set up to monitor the performance of the detectors spaced from 1/2 to 12 miles from ground zero and consisted of three dual-track magnetic tape recorders and a timing-pulse generator. The timing-pulse generator was designed to add timing pips to the recorded phenomena every 100 msec, beginning at time zero. The fourth group consisted of four oscilloscopes with recording cameras and photocell circuitry and was devoted to measuring the time-amplitude relationship of the thermal pulse. The fifth group included the miscellaneous circuitry for testing the various lines and equipments, power supplies, recording instruments for keeping track of the supply voltage, and the temperature within the instrumented detector. In addition, this group included a synchronizing pulse generator that developed a signal from the initial rise time of the thermal pulse of the explosion to trigger the sweep generators of all of the oscilloscopes

and to start the timing pulse generator. Another item was a teletypewriter connected to the service channel of the Bomb Alarm system which simplified the alignment and maintenance of the outgoing teletype circuitry and the establishment of testing procedure and schedules.

2.3 MANPOWER

Forty eight man weeks of preparation were required prior to shipment to the test site. An additional forty man weeks were spent at the site for the following purposes: to install the equipment, to keep it manned during dry runs, to check the status of equipment during inactive periods, and to keep the station manned in anticipation of and during the firing sequence.

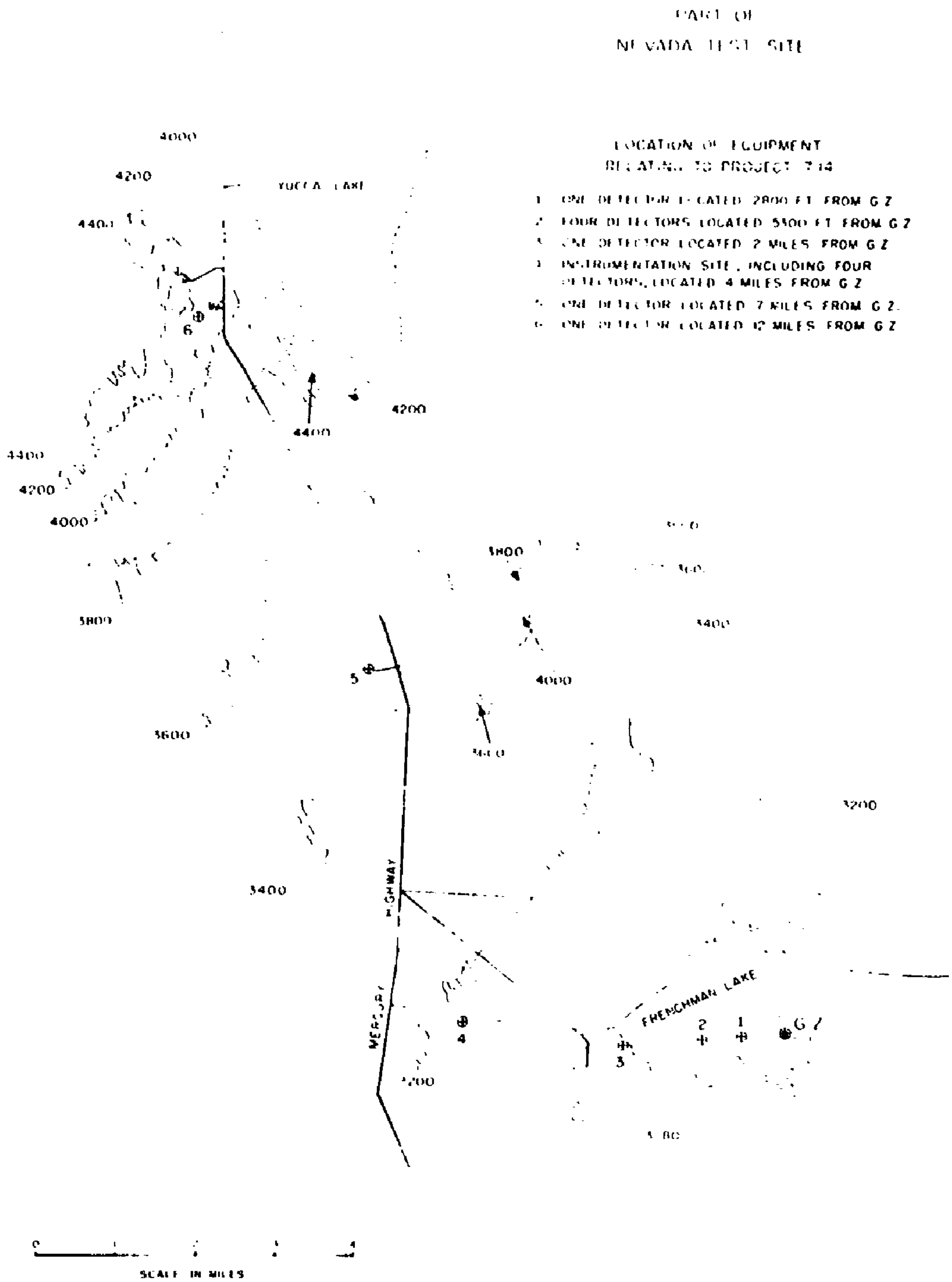

Figure 2.1 Location of equipment.

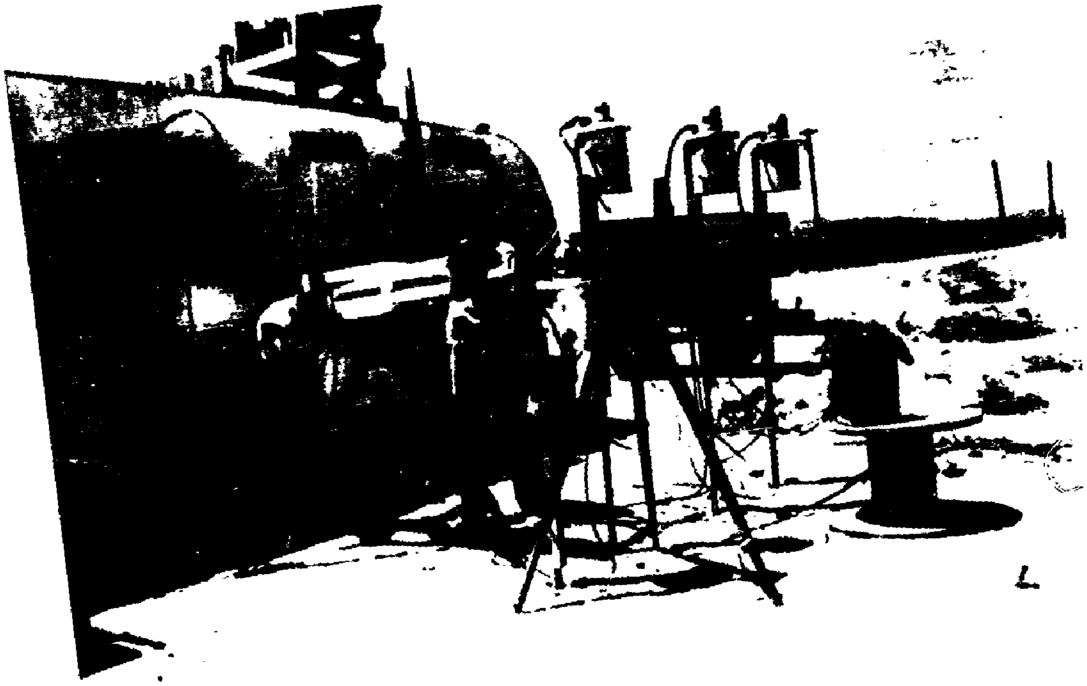

Figure 2.2 Instrumentation site.

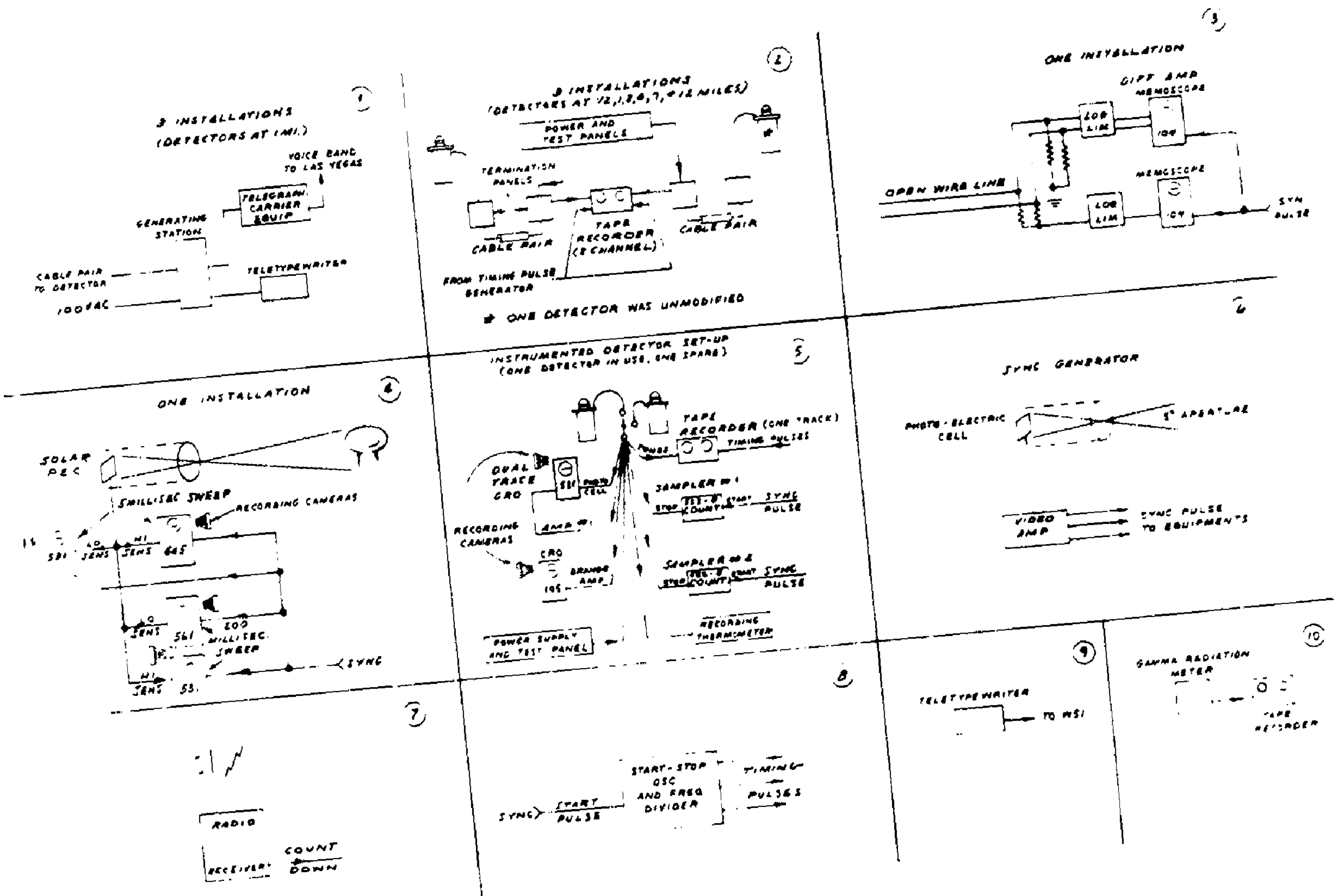

Figure 2.3 Instrumentation at trailer site.

CHAPTER 3

RESULTS AND DISCUSSION

Data determining the reliability of the 210-A Bomb Alarm sensors was recorded by oscilloscope cameras, tape recorders, teleprinters, and counters, recording the performance of the various sensors and the EM effects on the open-wire line.

At detonation time an absolutely perfect response from each of the three sensors connected to the Nationwide system brought up audible and visual red alarms on the communicators' panels and maps in the three display centers at the Pentagon and at Ent and Offutt Air Force Bases. The performance of the three generating stations was also monitored and recorded locally at the instrumentation site, at Las Vegas, at the master control stations and at other key repeater points. Figure 3.1 shows the nature of these records with a normal poll request BBBG and the normal green response of each station preceding and following the red alarm message of each station.

One sensor located at the instrumentation site was modified to enable the recording of the time-amplitude relationship of the output signal of the various detail elements of the sensor. Figure 3.2, upper trace, shows the output

of the photocell with respect to time, the lower trace shows the output of the main amplifier and Figure 3.3 the output of the secondary amplifier. The flares along the base line on these and other photographs were the result of multiple traces after the event took place and while the camera shutters were still open. The photocell output voltage is actually a logarithmic function of the thermal input. Both amplifiers are designed to saturate with nominal inputs. The tonal output of this sensor was also recorded on magnetic tape and when reviewed (Figure 3.4) was found to have gone through a normal alarm sequence from 1100 cps to 920 cps to 740 cps and then back to 1100 cps. A similar unit was monitored aurally and was also found to have functioned normally. Two electronic timers were also connected to this sensor to record the time after detonation that the various internal switches operated; the first should have switched at 2 msec, the second at 60 msec. Although the magnetic tape record showed that this detector operated properly, these monitoring timers were both turned off exactly 10 μsec after detonation by an interfering signal.

The five additional sensors located at 1/2, 1, 2, 4, 7 and 12 miles were monitored to confirm theoretical data on range and sensitivity. The tonal output of each of the sensors was recorded on electromagnetic tape along with timing

pulses to determine and record the fact and time of the shift in tones for each of the sensors. The timing pulses occur at 100-msec intervals, beginning within a μsec or two of the beginning of thermal emission. All sensors with the exception of those at 1/2 and 1 mile reacted as anticipated; those at 2, 4, and 7 miles functioned normally, while the one at 12 miles without a line of site view and near the theoretical distance limit did not react at all. The records of those sensors connected to the instrumentation site by cable showed the presence of an EM disturbance near time zero. The sensors at the instrumentation site were tied directly to the recording equipment and were free of such disturbances. The sensors at 1/2 mile and 1 mile reacted differently in several respects. The line to the sensor at 1 mile was completely free of EM effects, while the line to the 1/2-mile sensor was disturbed by a large EM transient beginning 72 msec after zero time. (Speculatively one might suggest that the fact that the cable from the two-mile point toward ground zero was lying on the ground had some effect on the EM disturbance and the disturbance at 72 msec was induced from other unrelated equipment in the near vicinity of the 1/2-mile sensor). The signal from these two sensors went directly from a 1100-cps tone to the 740-cps tone at time zero rather than through an intervening period of

at least 60 msec of 920-cps tone. We have not been able to simulate this reaction and therefore have no explanation to offer at this time. The other three sensors located at one mile reacted normally, because the generating stations will recognize a red signal only if it is preceded by a finite burst of orange tone. The generating stations have been thoroughly checked since their return to the laboratory and cannot be triggered to send a red alarm unless the orange tone precedes the red tone in the normal manner. Large electrostatic discharges by themselves or in combination with a coincident shift to 720 cps will not induce a red alarm.

Figures 3.5 through 3.13 are oscillographic photographs of the signals as stored on the various tapes. Figures 3.5 and 3.6 pertain to the sensor at the 1/2-mile point. Each shows the effects of a slight EM disturbance at time zero and a much larger disturbance beginning at 72 msec. Figure 3.6 is to a scale of 10 msec per division and shows the details of the disturbances in best detail. Figure 3.5, with a scale of 100 msec per division, illustrates the direct frequency shift from 1100 cps to 740 cps. The small spikes are those 100-msec timing pulses that were not suppressed by the frequency discriminator. The large interference signal is also evident at 72 msec.

Figures 3.7 and 3.8 pertain to the sensor at the 1-mile point (Figure 3.14). With the time scale of 50 msec per division, Figure 3.7 shows the

complete absence of EM effects from a time more than 100 msec before to nearly 400 msec after time zero. The shift to 740 cps, illustrated by the change in amplitude at time zero, is also illustrated. Figure 3.8, with a time scale of 100 msec per division, shows the direct shift to 740 cps at time zero. Most of the 100-msec timing pulses are visible, beginning with the frequency shift to 740 cps.

Figures 3.4 and 3.9 illustrate the reaction of the sensor at the 2-mile point. Both show the rather violent effect (presumably from EM causes) lasting for nearly 20 msec. The shift in tone from 1100 cps to 920 cps at zero time and to 740 cps at 60 msec is clearly illustrated in Figure 3.4. Figure 3.9 (showing voltage amplitude vs time) best illustrates the nature of the EM effect.

Figure 3.10 illustrates the behavior of the sensor at the instrumentation site (the 4-mile point). Since no cable was involved, (the sensor was directly connected to the tape recorder), the equipment was not susceptible to EM induction. The shift in frequency from 1100 cps to 940 cps at zero time is illustrated, as well as the further shift to 740 cps at 60 msec.

Figure 3.11 illustrates the performance of the sensor located 7 miles from ground zero. An induced potential pulse, because of EM effect on the cable, can be seen near zero time.

The shift in tones from 1100 cps to 920 cps to 740 cps is clearly illustrated, along with the 100-msec timing pulses.

Figures 3.12 and 3.12a pertain to the sensor located on a hill back of CP-1 about 12 miles from ground zero. The view of the area immediately adjacent to ground zero was obstructed by intervening hills. It is believed that at least part of the fireball was visible from this point. Figure 3.12 shows the effects of a disturbance at time zero, 100-msec timing pulses, and nothing more. Figure 3.12a confirms the fact that there was no shift in tone, either to 920 cps or 740 cps. Due to extreme range, this sensor was not expected to detect the blast; no more than a possible shift to 920 cps was anticipated.

Figures 3.13 and 3.13a illustrate the performance of a standard detector that was not modified to react to the smaller event. This detector does its internal sampling at 30 msec and at one second. Since this sensor was mounted at the instrumentation site, there is no evidence of any EM effects. The absence of disturbances is illustrated in Figure 3.13, which illustrates amplitude effects to best advantage — only the timing pulses are visible. Figure 3.13a illustrates the frequency shift to 920 cps near time zero and a return to 1100 cps in about two seconds. This is completely normal; any sudden bright light will cause a shift to 920 cps. There

was no shift to 740 cps because of the short duration of the smaller event. The significance of this effect is that the sensors in the alarm system, which were designed to Air Force supplied criteria, will not in fact react to explosions of weapons whose yields are as small as the one under test.

While results of the measurement on the open-wire line are somewhat inconclusive, valuable data were recorded. Obviously, the time scale was short of ideal. Figure 3.15 indicates a voltage swing of at least plus and minus 400 volts (the traces may have gone off scale) between the open-wire line and ground. The driven ground at the 1/2-mile end of the line was of doubtful quality, and it is doubtful whether the spark gap protectors operated to full advantage. With the equipment back in the laboratory, the only way the pattern can be duplicated is with the ground at the 1/2-mile point missing. Figure 3.16 indicates the differential potential between the wires of the pair. With an effective ground, the differential voltage increases faster because of the fact that the arrestors are not exactly identical, do not spark over at exactly the same time and in the same way, therefore generating fairly large instantaneous differential potentials. Tests in the laboratory both now and in the past, when the system was being designed, indicate that potentials of the sort experienced

during the explosion and various other types simulated in the laboratory have little effect on the performance of the system. A direct hit or near miss by lightning or a nuclear explosion will undoubtedly incapacitate a sensor or its allied equipment but not in such a way as to render the other sensors of a given target area inoperable.

Additional evidence with respect to EM effects may be gathered from an observation at the time of the blast and an examination of the records. At the time of the blast a sparking over was observed at the trailer termination of the open-wire line. It has been noted that the electronic timers, which were started by the synchronizing pulse and were intended to measure the sampling times of the instrumented detector, were actually both shut off ten μsec after they were started. Further, an examination of the oscilloscope trace of the rise time of the first pulse of the thermal emission shows an extraneous pulse rising to a first peak in ten μsec and a second higher peak in an additional ten μsec.

It is suggested that the above three bits of information were related to the same phenomenon. It is suggested that the most severe disturbance associated with the EM effect lasted for no more than 20 μsec, because a pulse of this duration was conducted to the instrumentation site by the open-wire line.

The time duration can be determined by the interfering signal induced into the oscilloscope circuitry and recorded along with the rise time of the first thermal pulse. It is also suggested that this same pulse was induced into the timer circuitry and was the cause of the timers having been shut off at ten μsec. The fact that a spark was observed indicates a high voltage; the fact that it was observed at the open-wire line termination fixes its source as the open-wire line. Therefore, a high-voltage, high-frequency signal was conducted into the trailer by the open-wire line.

Because of the inexact nature of available information concerning the time-amplitude characteristic of the thermal emission, a photocell and measuring circuitry were included in the instrumentation which would enable us to check our design parameters. The pass band of the system was good enough to enable us to see at least a 2 μsec rise time. Two oscilloscopes were set up with differing amplitude sensitivities to record the characteristics of the first thermal pulse. These scopes were set to sweep rates of 50 μsec per centimeter for a total sweep time of 500 μsec. The sensitivity of the first was such as to render the trace useless. The second showed the pulse in all the detail hoped for. Figure 3.17 is a copy of this second trace.

Two additional oscilloscopes were also set up to measure the nature of the second thermal pulse. Figure 3.18 is a copy of the pattern developed by the high sensitivity instrument and is useful for the detail given at low levels. For instance, after the first pulse, the intensity dropped to less than 1,000 ft-candle. Figure 3.19 gives a good overall picture.

The time duration and the amplitudes of both pulses checked our design parameters exactly within the accuracy of the measurements. For a weapon of Small Boy's size, the equipment had been tailored to react to a rise time of 50 μsec and a first pulse duration of 3 msec. It was anticipated the second pulse would rise to peak amplitude in 60 msec. It was also anticipated that the peak intensity should be near 100,000 ft-candle at the instrumentation site. It will be noted that all of these figures were in fact verified.

Since it was felt that some knowledge of the radiation intensities was of interest, a spare channel on one of the tape recorders was used to record the response of a portable gamma-detection instrument. Figure 3.20 shows the individual pulses during the first 10 msec of the explosion and indicates a pulse rate near or beyond the frequency capability (15,000 cps) of the tape recorder. Figure 3.21 is an integrated record of the first second after time zero and indicates that

essentially all of the gamma radiation took place within 0.5 sec. The peak reading on the meter on the instrument was 10 mr; however, the short duration of the pulse and the time constant of the metering circuit may have been such as to make this a low reading.

Since this was a desert installation during the hottest part of the year, it was anticipated that the temperatures within the detectors might be of interest. Thermal elements were installed in the instrumented detectors and the temperature of the one connected to the system was monitored on a 24-hour basis. The temperatures encountered were (within calibration accuracies) the same as those measured in the shade. The white paint used is apparently quite effective in keeping the temperatures within the sensors near ambient.

BBBG GGBW GGBCYGGBCYBBBG GGBW
BBBG JGBW JGBCYJGBCYBBBG JGBW
BBBG MGBW MGBCYMGBCYBBBG MGBW

POLL	GREEN RESPONSE	1 ST. RED	2 ND. RED	POLL	GREEN RESPONSE

Figure 3.1 Teletype record of red alarms.

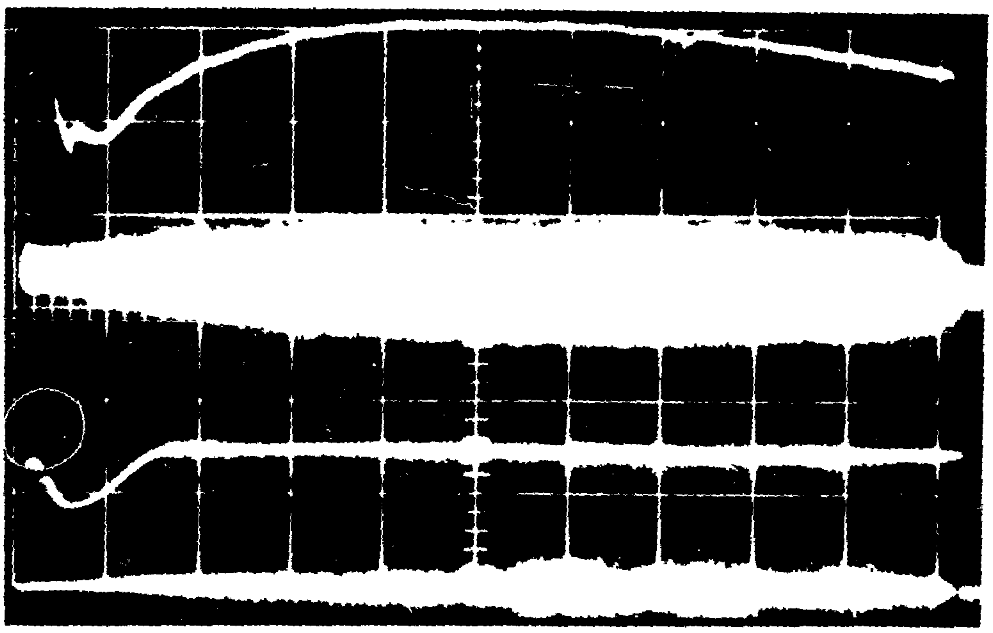

Figure 3.2 Photocell and main amplifier performance.

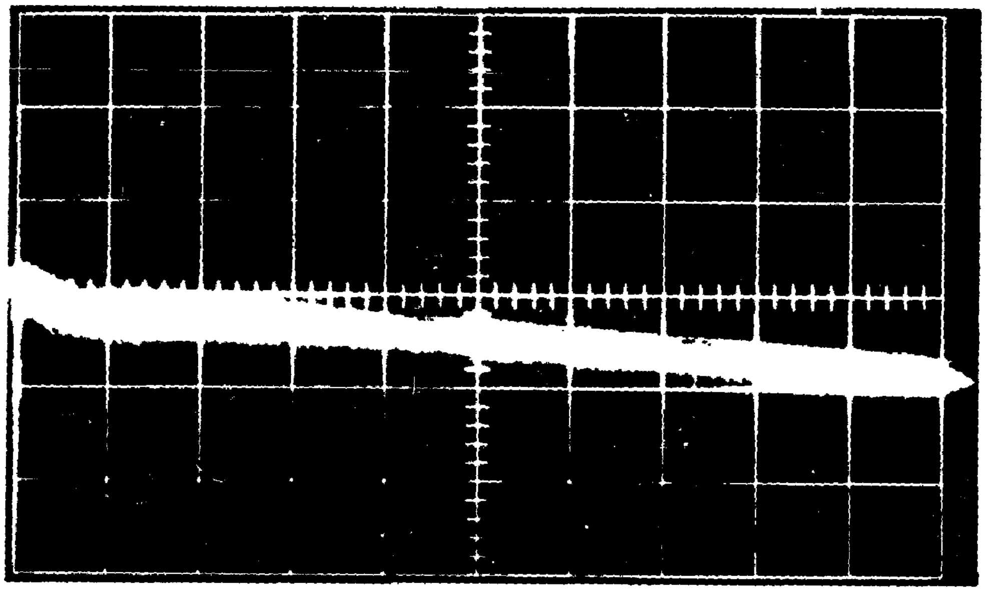

Figure 3.3 Orange amplifier performance.

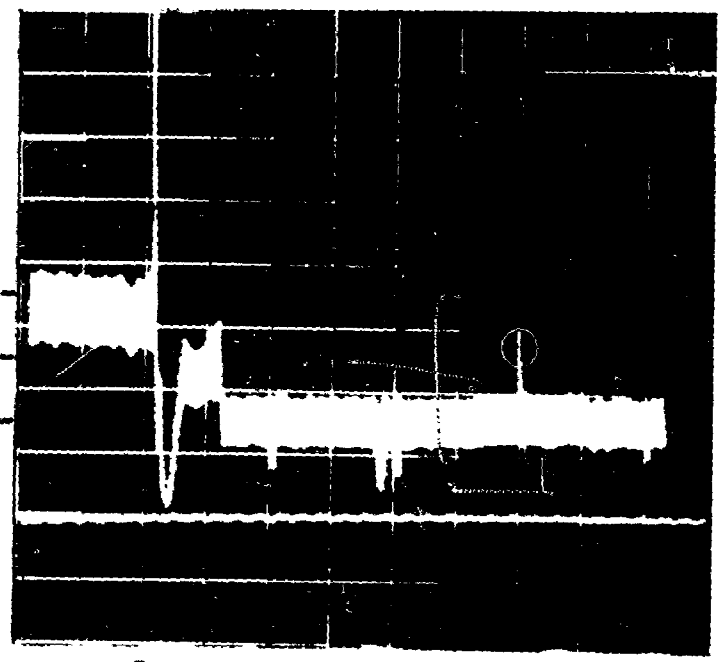

Figure 3.4 Performance of two-mile detector.

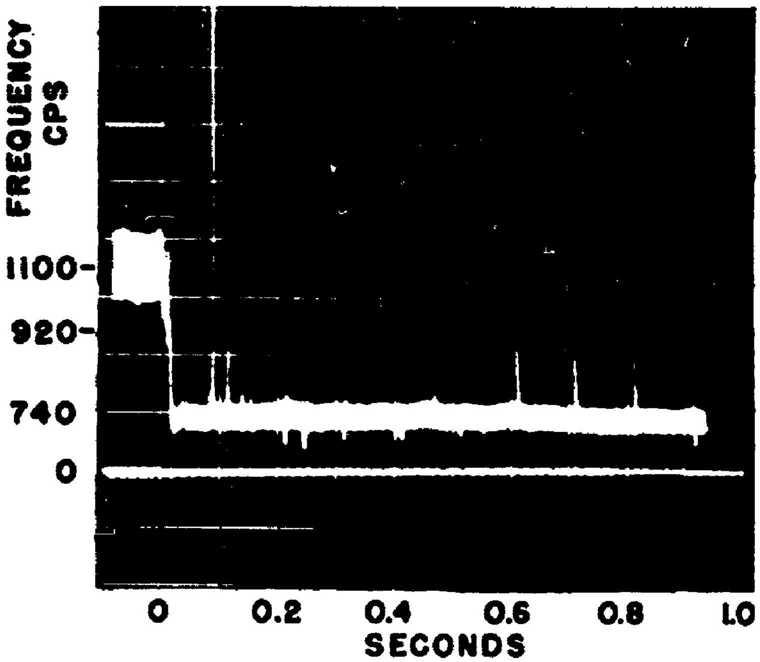

Figure 3.5 Performance of one-half-mile detector (seconds).

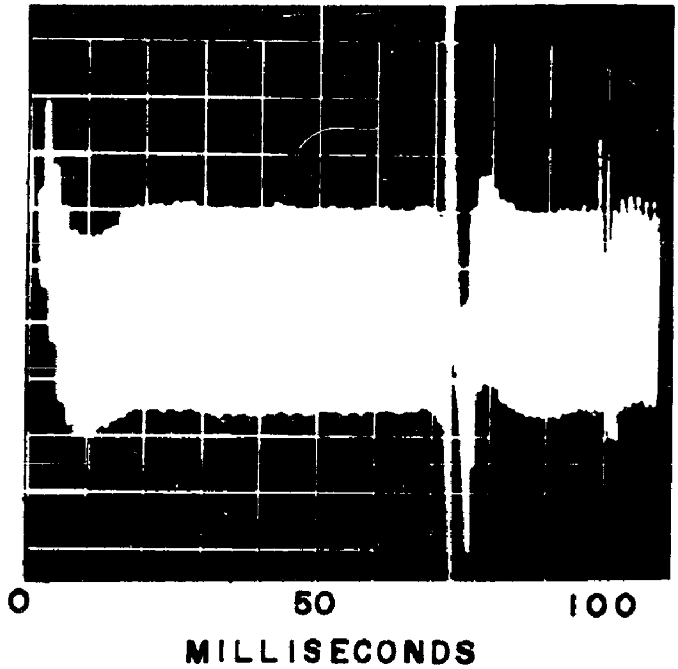

Figure 3.6 Performance of one-half-mile detector (milliseconds).

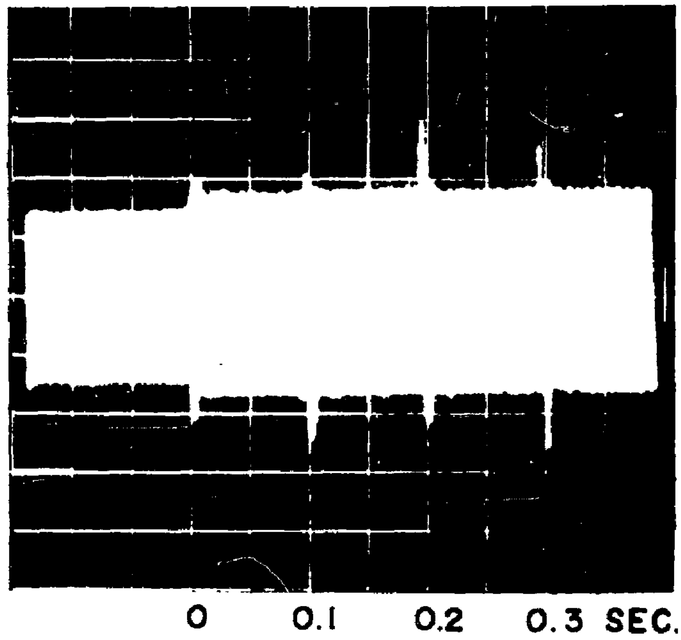

Figure 3.7 Performance of one-mile detector.

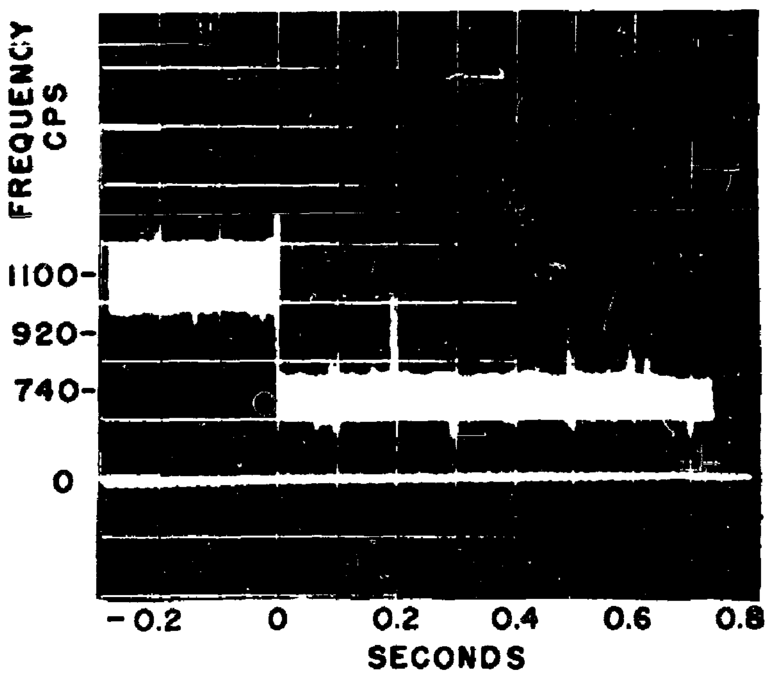

Figure 3.8 Performance of one-mile detector (seconds).

Figure 3.9 Performance of two-mile detector.

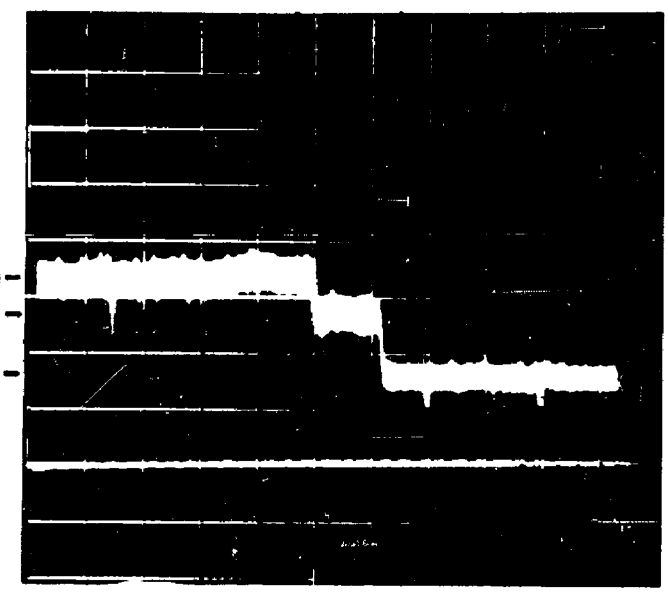

Figure 3.10 Performance of four-mile detector.

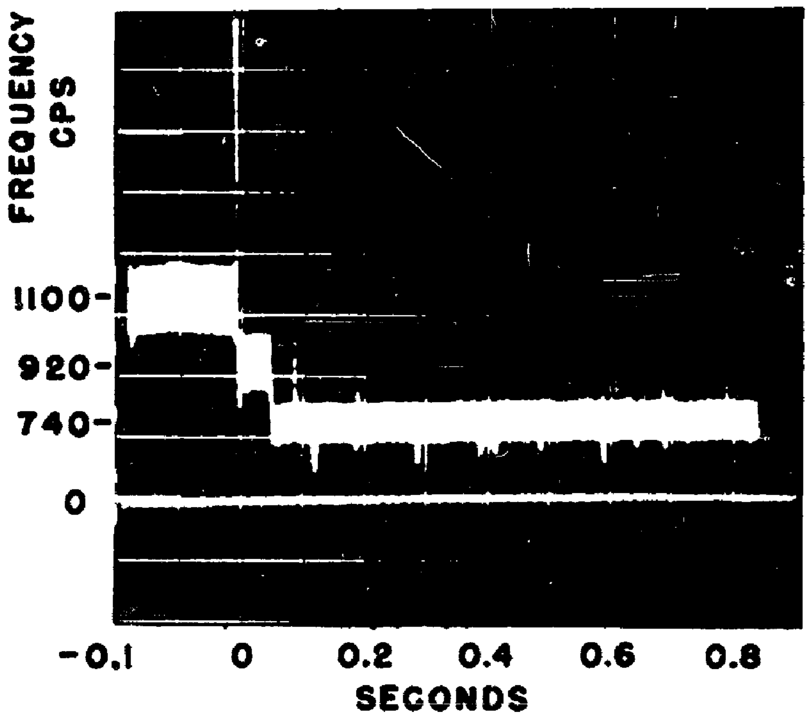

Figure 3.11 Performance of seven-mile detector.

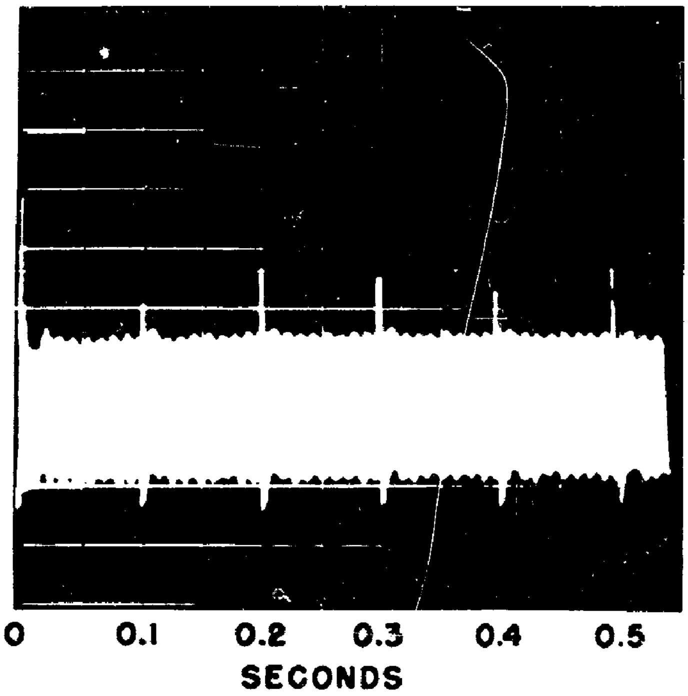

Figure 3.12 Performance of twelve-mile detector (time = zero).

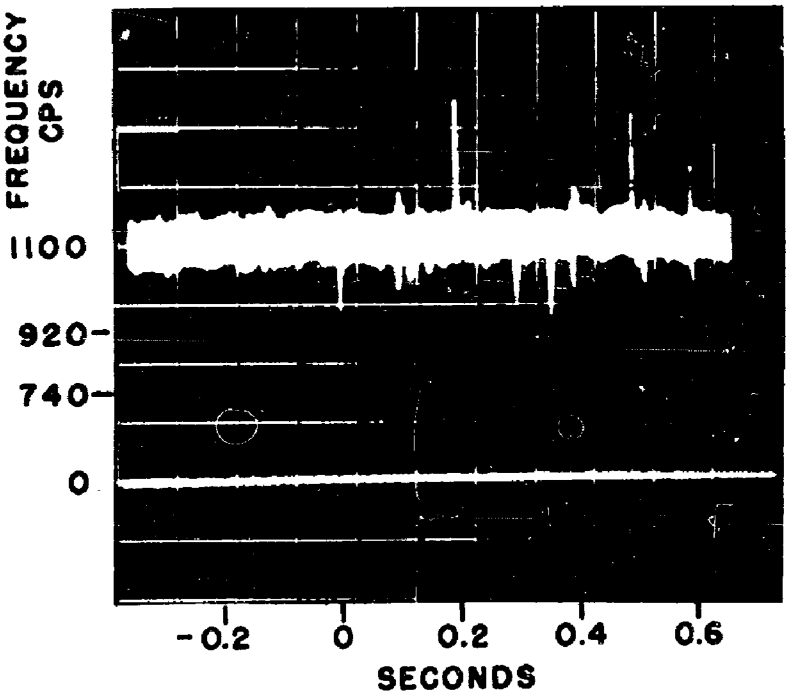

Figure 3.12a Performance of twelve-mile detector (time = zero).

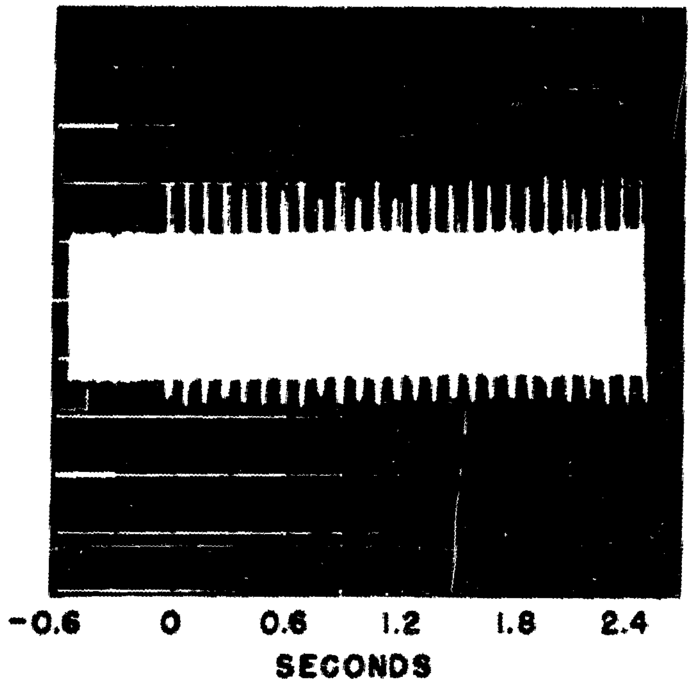

Figure 3.13 Performance of unmodified detector (only timing pulses visible).

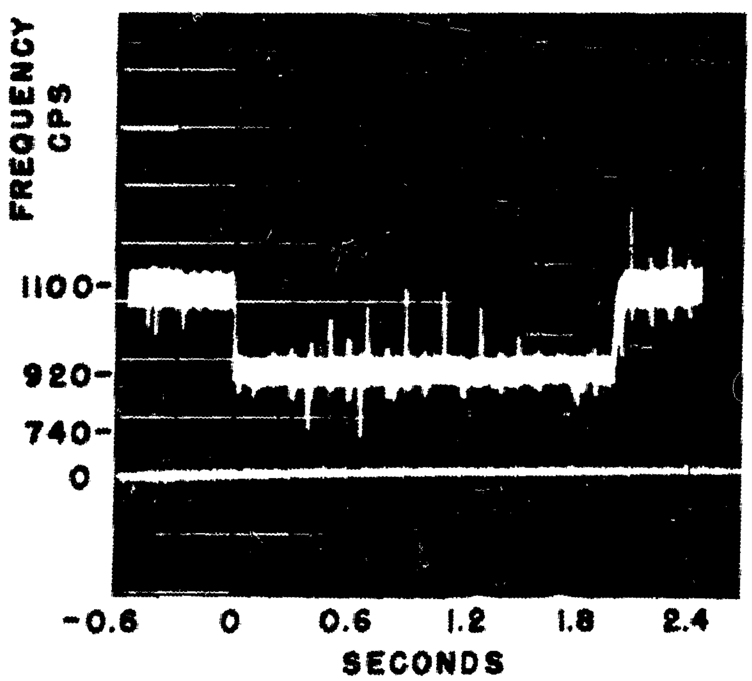

Figure 3.13a Performance of unmodified detector (only timing pulses visible).

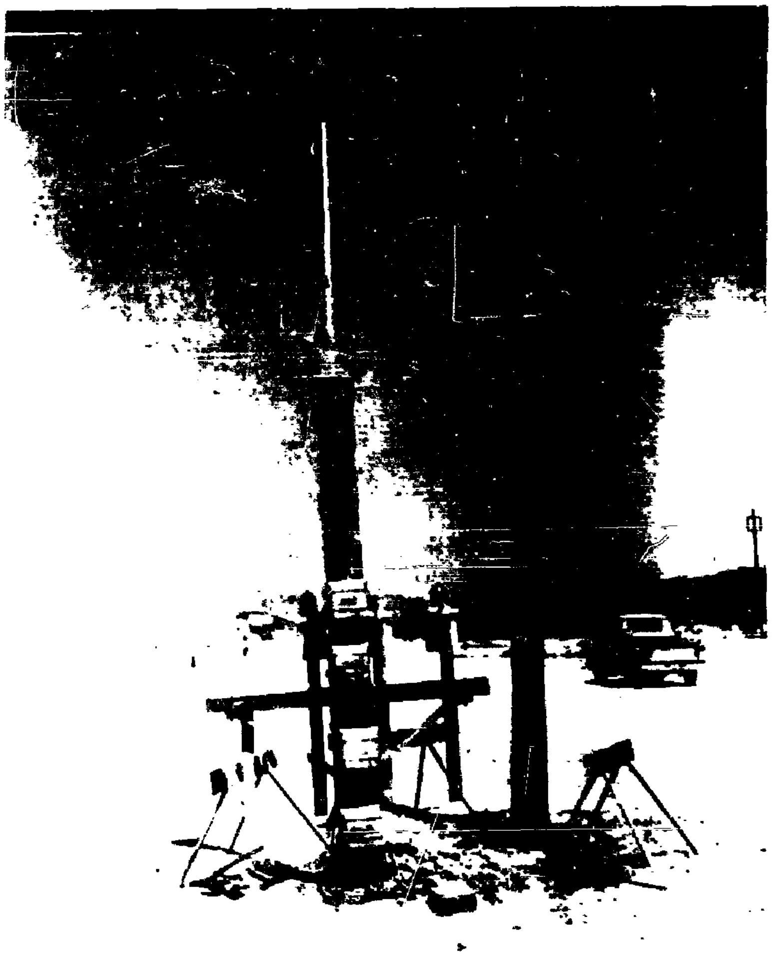

Figure 3.14 One-mile detector installation and portion of open-wire pole line.

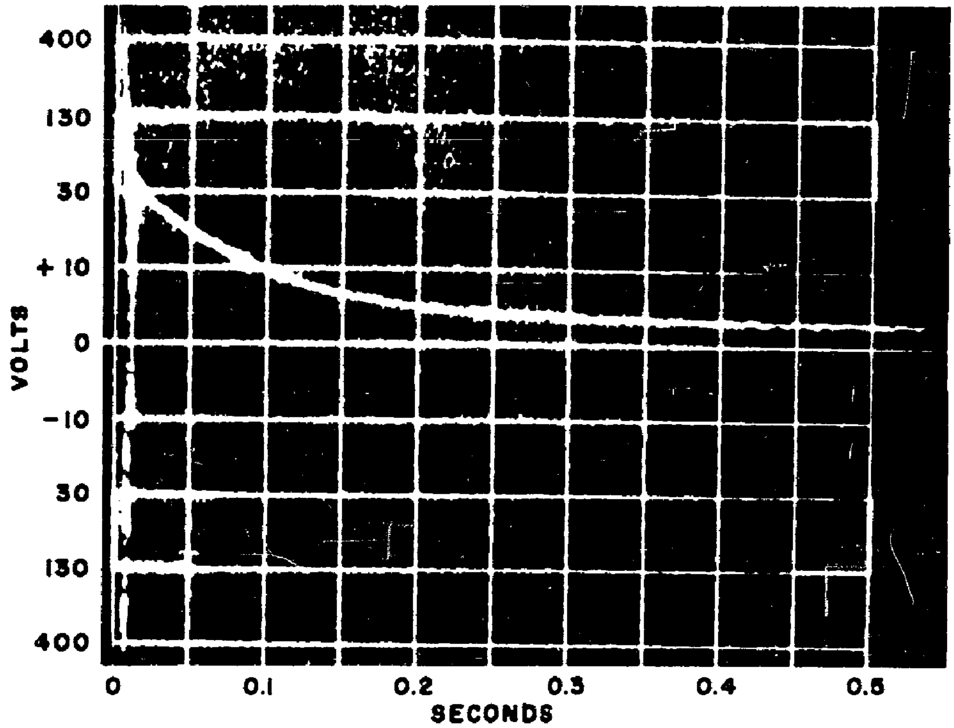

Figure 3.15 Line-to-ground potential.

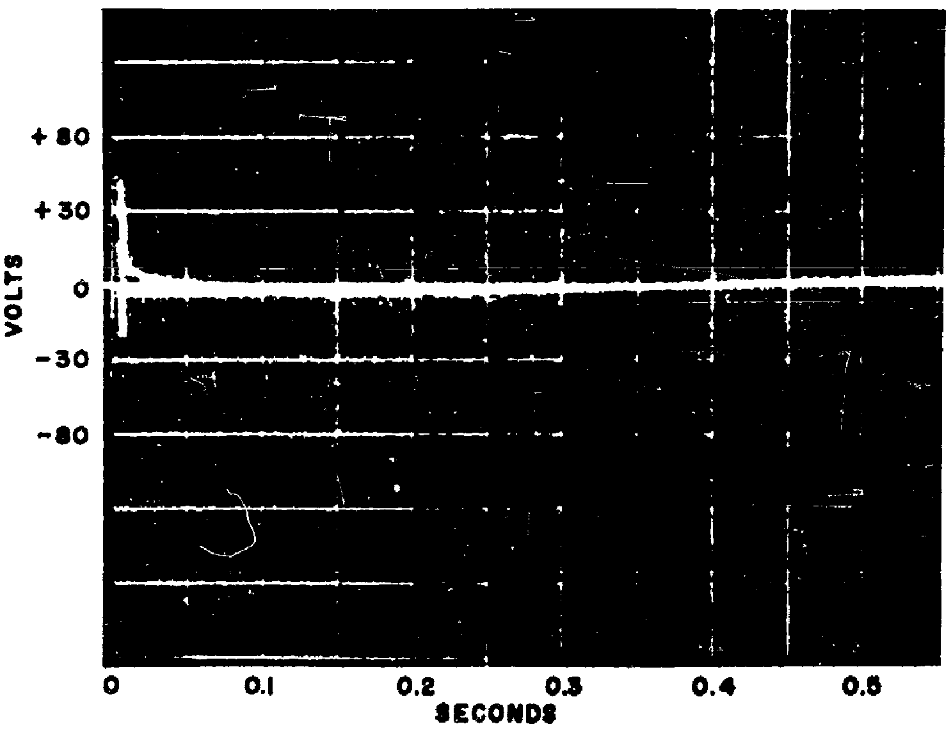

Figure 3.16 Potential between wires.

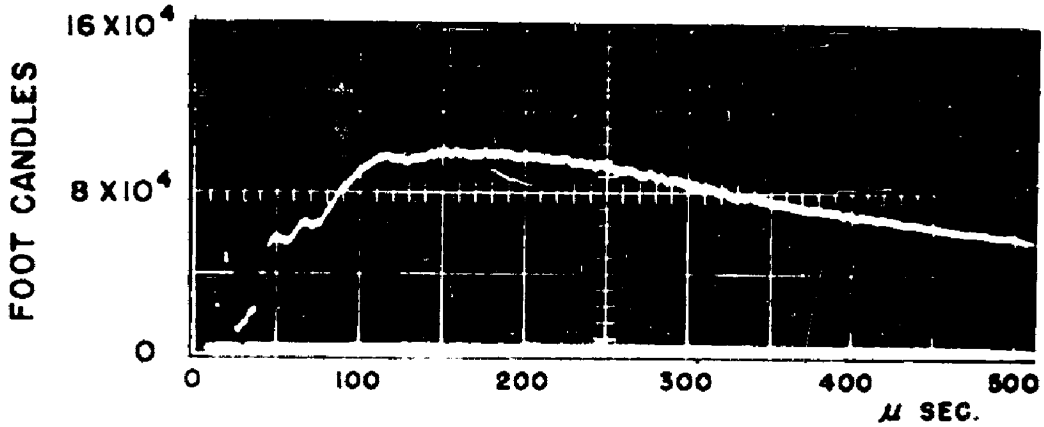

Figure 3.17 First thermal pulse.

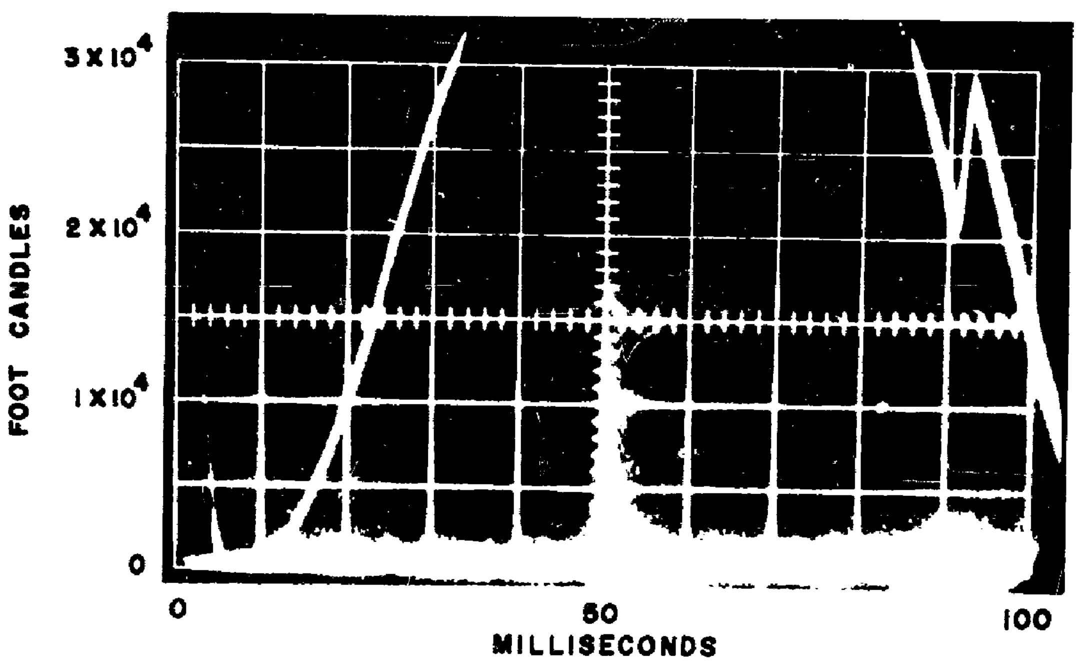

Figure 3.18 Second thermal pulse.

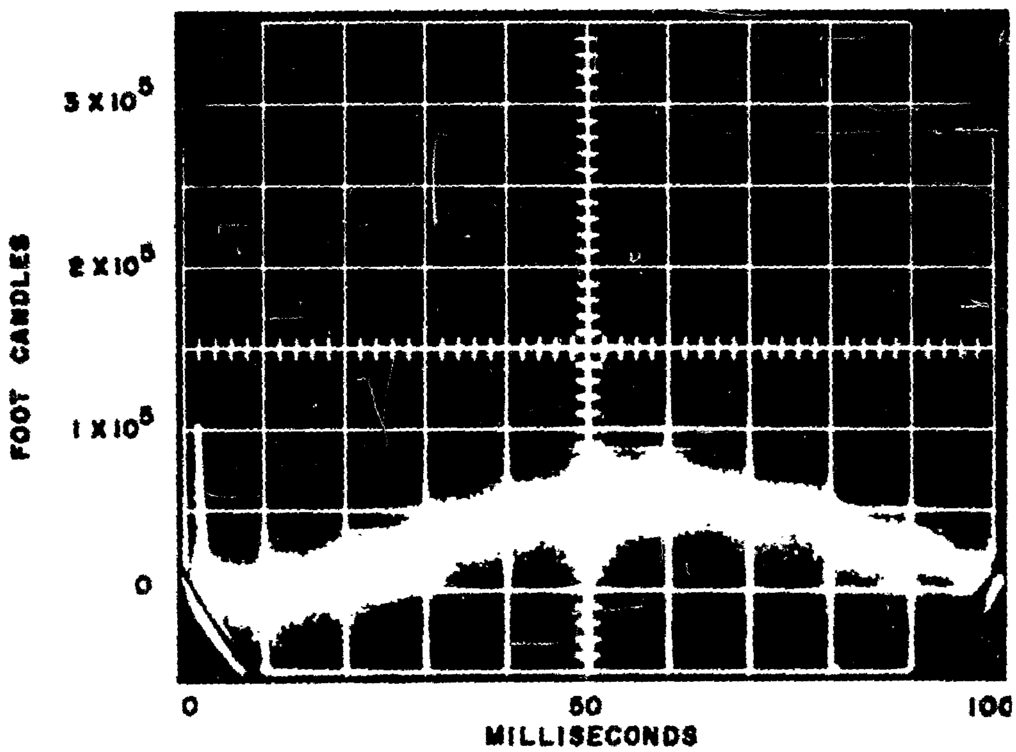

Figure 3.19 Second thermal pulse (overall).

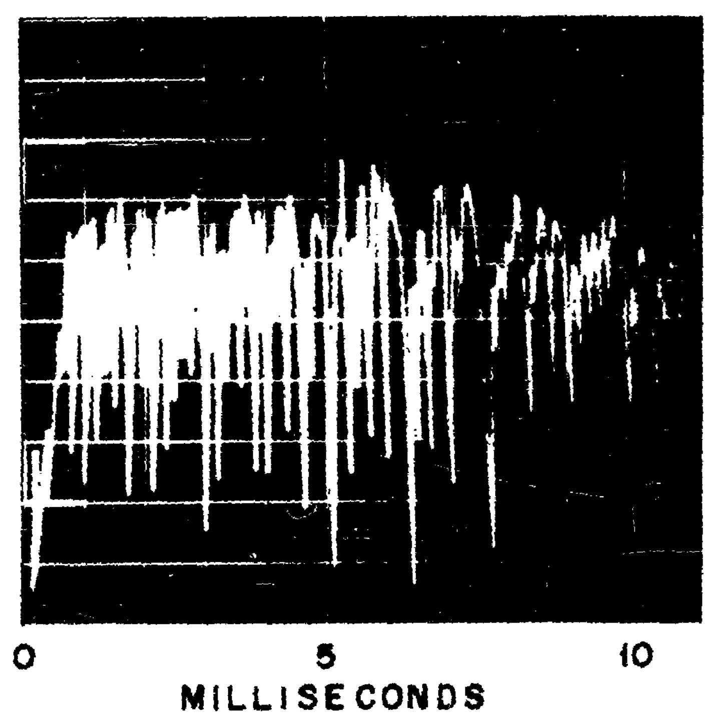

Figure 3.20 Gamma radiation at four miles (milliseconds).

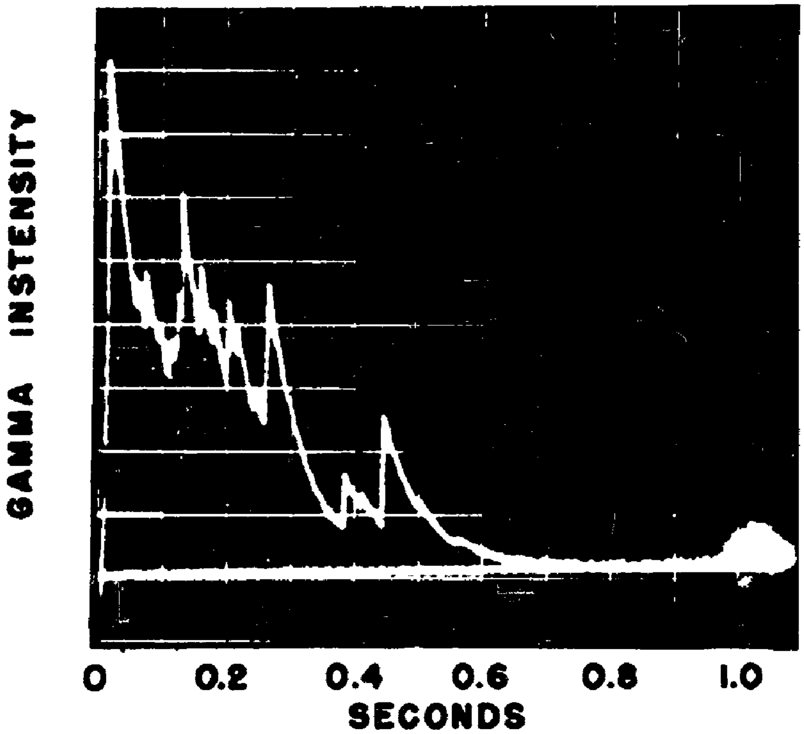

Figure 3.21 Gamma radiation at four miles (milliseconds).

CHAPTER 4

CONCLUSIONS

The primary objective of this test was to ascertain evidence relative to the operation of the Bomb Alarm System, and not to gather scientific data. From the data gathered, the fact was established that the detectors possess the ability to recognize, upon occurrence, a nuclear event, to transmit a message to this effect, and to activate the appropriate elements of the display equipments. The data gathered also confirms theoretical calculations relative to the sensitivity and range of the detectors in that this data checks very well the thermal pulse model used in the design of the detectors.

A secondary objective was to record electromagnetic effects on an open-wire line. Review of the data recorded on the open-wire facility indicates that phenomena similar to those experienced in connection with lightning storms were present, and no adverse effects that would disrupt the transmittal of a signal from the detector and/or signal-generating station were experienced.

Further, by tests performed on all of the circuits and detectors immediately after the data was taken and recorded, it was determined that all of the equipments were in as good condition as before the test. None of the equipment suffered any damage as a result of the test.

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Operation SUNBEAM, SHOT SMALL BOY
Project Officers Report – Project 7.14,
Bomb Alarm Detector Test, Issuance Date:
April 19, 1963.

Distribution statement **"A"** now applies.

Ardith Jarrett
ARDITH JARRETT
Chief, Technical Resource Center

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